

MATERIAL SAFETY DATA SHEET

SRM Supplier: National Institute of Standards and Technology
Standard Reference Materials Program
Bldg. 202 Rm. 211
Gaithersburg, Maryland 20899

SRM Number: 3161a
MSDS Number: 3161a
SRM Name: Tin Standard Solution
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SECTION I. MATERIAL IDENTIFICATION

Material Name: Tin Standard Solution

Description: SRM 3161a is a 50 mL single element solution prepared gravimetrically to contain a nominal 10 mg/g of tin with an approximate nitric acid and hydrofluoric acid combined volume fraction of 5 % and 2 % respectively.

Other Designations: **Tin** (tin flake; wang; stannum) in **Nitric Acid** (aqua fortis; hydrogen nitrate; azotic acid; engravers acid); ***Tin Nitrate** (stannous nitrate)/**Hydrofluoric Acid** (hydrogen fluoride; fluorhydric acid) in **Standard Solution**

Name	Chemical Formula	CAS Registry Number
Nitric Acid	HNO ₃	7697-37-2
Hydrofluoric Acid	HF	7664-39-3
Tin	Sn	7440-31-5
Tin Nitrate	Sn(NO ₃) ₄	41480-79-9

DOT Classification: Corrosive Liquid, Toxic
N.O.S. (Nitric Acid and Hydrofluoric Acid) UN2922

Manufacturer/Supplier: It is available from a number of suppliers.

*The addition of tin to nitric acid, along with other intermediate chemical reactions, forms tin nitrate which will precipitate upon evaporation or drying of the solution.

SECTION II. HAZARDOUS INGREDIENTS

Hazardous Components	Nominal Concentration (%)	Exposure Limits and Toxicity Data
Nitric Acid	5	ACGIH TLV-TWA: 2 mg/kg or 5 mg/m ³
		OSHA TLV-TWA: 2 mg/kg or 5 mg/m ³
		Human, Oral: LD ₅₀ : 430 mg/kg
Hydrofluoric Acid	2	ACGIH Ceiling: 3 mg/kg or 2.5 mg/m ³
		OSHA TLV-TWA: 3 mg/kg or 2.55 mg/m ³
		Human, Inhalation: LC ₅₀ : 50 mg/kg/30 min
		Man, Inhalation: TC ₅₀ : 100 mg/m ³ /5 min
Tin Nitrate	3.08	ACGIH TLV-TWA: 2 mg/m ³
		OSHA TLV-TWA: 2 mg/m ³
Tin	1	ACGIH TLV-TWA: 2 mg/m ³

SECTION III. PHYSICAL/CHEMICAL CHARACTERISTICS

Nitric Acid	Hydrofluoric Acid
Appearance and Odor: a colorless to slightly yellow liquid that darkens to a brownish color upon aging and exposure to light; irritating, pungent odor	Appearance and Odor: A colorless, fuming liquid with a strong, irritating, pungent odor.
Relative Molecular Mass: 63.02	Relative Molecular Mass: 20.01
Density: 1.03 (5 % nitric acid)	Density: 0.987 to 0.991
Solubility in Water: soluble	Solubility in Water: soluble
Solvent Solubility: decomposes in alcohol.	Solvent Solubility: soluble in alcohol, benzene, toluene, <i>m</i> -xylene, and tetralin

Tin Nitrate	Tin
Appearance and Odor: silky crystals	Appearance and Odor: a lustrous, white powder or solid; odorless
Relative Molecular Mass: 366.71	Relative Atomic Mass: 118.69
Density: N/A	Density: 7.28
Solubility in Water: decomposes in cold water	Solubility in Water: insoluble
Solvent Solubility: N/A	Solvent Solubility: soluble in hydrochloric acid, sulfuric acid, aqua regia, and alkali solutions

NOTE: The physical and chemical data provided are for the pure components. Physical and chemical data for this tin/nitric acid/hydrofluoric acid solution do not exist. The actual behavior of the solution may differ from the individual components.

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point:	N/A	Method Used:	N/A	Autoignition Temperature:	N/A
Flammability Limits in Air (Volume %):	UPPER:	N/A			
	LOWER:	N/A			

Unusual Fire and Explosion Hazards: Although nitric acid does not burn, it is a powerful oxidizing agent that can react with combustible materials to cause fires. Hydrofluoric acid is a negligible fire hazard when exposed to heat and/or flames. Hydrofluoric acid may ignite or explode on contact with combustible materials.

Extinguishing Media: Use extinguishing media that is appropriate to the surrounding fire. Use a water spray to dilute nitric acid and to absorb liberated oxides of nitrogen.

Special Fire Procedures: Fire fighters should wear a self-contained breathing apparatus (SCBA) with a full face piece in the pressure-demand or positive-mode and other protective clothing.

SECTION V. REACTIVITY DATA

Stability: X Stable _____ Unstable

Conditions to Avoid: Avoid contact with combustible and other incompatible materials.

Incompatibility (Materials to Avoid): Keep nitric acid from contact with acids, bases, amines, halogens, halo carbons, cyanides, metals, metal oxides, metal salts, metal carbides, peroxides, oxidizing materials, and reducing agents. Hydrofluoric acid is incompatible with amines, bases, metal oxides, cyanides, combustible materials, halogens, metals, oxidizing materials, metal salts, and reducing agents.

See Section IV: *Unusual Fire and Explosion Hazards*

Hazardous Decomposition or Byproducts: Hazardous decomposition of nitric acid and/or tin nitrate can produce various nitrogen oxides, including nitric oxide (NO), nitrogen dioxide (NO₂), nitrous oxide (N₂O), as well as nitric acid mist or vapor. Thermal decomposition of hydrofluoric acid may release halogenated (fluorinated) compounds. Thermal decomposition of tin and tin nitrate may release toxic and/or hazardous gases.

Hazardous Polymerization: _____ Will Occur X Will Not Occur

SECTION VI. HEALTH HAZARD DATA

Route of Entry: X Inhalation X Skin X Ingestion

Health Hazards (Acute and Chronic): Nitric Acid : Nitric acid may be fatal if inhaled, swallowed, or absorbed through skin. This material causes burns and is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin. Inhalation may be fatal as a result of spasm, inflammation, and edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting.

Hydrofluoric Acid: Hydrofluoric acid may be fatal if inhaled, swallowed, or absorbed through the skin. This material causes burns and is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin. Inhalation may be fatal as a result of spasm, inflammation, and edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting. Repeated exposure to low concentrations may cause nasal congestion, nosebleeds, sinus problems, and bronchitis.

Direct eye contact with hydrofluoric acid may range from mild irritation to corneal burns. If the solution is not promptly removed, permanent visual defects and blindness may result. Hydrofluoric acid burns are characterized by blanched appearance of the skin with excruciating pain. Both the liquid and the vapor can cause severe burns that may not be immediately painful or visible. Solutions less than 2 % may cause burns. The full extent of tissue damage may not exhibit itself for 12 hours to 14 hours after exposure. Hydrogen fluoride will penetrate the skin and attack the underlying tissues and bone. Profound hypocalcemia can occur sometimes with fatal results. Chronic effects can include changes in bones and joints in humans.

Tin and Tin Nitrate: Inhalation of tin and inorganic tin compounds may cause respiratory irritation. Metal fume fever, an influenza-like illness, may occur due to the inhalation of freshly formed metal oxide particles. Symptoms may begin with a sudden onset of thirst and a sweet, metallic or foul taste in the mouth. Other symptoms may include lassitude and a generalized feeling of malaise. Fever, chills, muscular pain, mild to severe headache, nausea, occasional vomiting, exaggerated mental activity, profuse sweating, excessive diarrhea, and prostration may also occur. Tolerance to fumes develops rapidly, but is quickly lost.

Skin and/or eye contact with tin inorganic compounds may cause irritation. Ingestion of tin compounds is relatively nontoxic due to poor absorption. At very high levels, abdominal pain, nausea, vomiting, gastric irritation, and diarrhea may occur. Repeated or prolonged ingestion of small quantities may cause abdominal pain, nausea, constipation, and loss of weight.

Listed as a Carcinogen/Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens	_____	X
In the International Agency for Research on Cancer (IARC) Monographs	_____	X
By the Occupational Safety and Health Administration (OSHA)	_____	X

Ingestion: If ingestion occurs, wash out mouth with water. **DO NOT** induce vomiting. Obtain medical assistance immediately.

TARGET ORGAN(S) OF ATTACK:

- Nitric Acid:** skin, teeth, eyes, and upper respiratory tract
- Tin Nitrate and Tin:** upper respiratory tract (URT)
- Hydrofluoric Acid:** skin and skeletal system

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Store this material at room temperature.

SECTION VIII. SOURCE DATA/OTHER COMMENTS

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use in assessing the hazardous nature of the material. The MSDS was prepared carefully using current references; however, NIST does not certify the data on the MSDS. The certified value for this material is given on the NIST Certificate of Analysis.